Auxiliary Spillway Layout

Auxiliary Spillway Layout Using the NRCS Tool

Overview: Create the surface model and earthwork volumes for the auxiliary spillway component of a pond embankment. The auxiliary spillway surface will tie into the embankment slope projections. Design elevations and dimensions of the auxiliary spillway from SITES or WinPond are needed in this process.

Software: AutoCAD Civil 3D 2016, Civil 3D Workspace, NRCS C3D 2016 template V1.0 (6/24/16), NRCS Customization v1.1

Prerequisite: A surveyed site with a surface model covering the footprint of the dam is needed. Create the pond embankment top of fill, but not slope projections. Refer to the instructions for Pond Embankment: “Placing the Centerline & Top of Dam”.

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Grade the slopes of the embankment for a preliminary layout. Ignore any wave berm.

1) **Click Home... Create Design... Grading... Grading Creating Tools...**

2) **Click Set the Grading Group**

3) **Set the Site to Embankment. Click OK**

4) **Input a Grading Group Name as {Embankment} Click OK**

5) **Click Set the Target Surface**, Select Ond. Click OK

Downstream & Upstream embankment toe (preliminary)

6) **Pulldown the Select a Grading Criteria to Slope or Grade to Surface (Fill)**

7) **Click Create Grading**

8) **Select** the downstream edge of the dam. Click downstream of the dam.

9) **Apply to entire length? Input Y Press Enter**

10) **Slope or grade? Input S Press Enter.**

11) **Fill Slope? Input 3. Press Enter.**

12) **Select** the upstream edge of the dam. Click upstream of the dam.

13) **Apply to entire length? Input Y Press Enter**

14) **Slope or grade? Input S Press Enter.**
16) Press ESC to exit the command
17) Close the Grading Tool
18) Use Analyze...Inquiry... Distance... to show the backslope distance and help determine the Outlet Length (Straight) needed for the spillway layout.

**Placing the Spillway Layout**

19) From Civil 3D Click NRCS ... NRCS Dams... Auxiliary Spillway ....
20) Input the dimensions, slopes, radius and auxiliary spillway elevation. Use the dike height that accounts for the actual overfill where the spillway dike joins the dam.
21) Set these:
   A- Feature Line Style to Auxiliary Spillway Feature Line.
   B – Alignment Style to Embankment
   C- Elevation Label Style to Feature Line Elevation End
22) For a spillway at the left end of the embankment leave the Mirror box Unchecked. For a spillway at the right end, Checkmark Mirror.

Note: If a second option for a spillway layout is being inserted, the AcadGroup Name should be changed to AuxSpill2. (Spaces are NOT allowed in the name)

23) Click Insert into Drawing. Select an insertion point in CAD for the upstream inside corner of the spillway level section.
Note: The spillway objects can be selected as a group or separately.
Separately: Click NRCS ... NRCS Storage Ponds...
Turn Off: Selection by Group.
As a group: Use Turn On: Selection by Group.

24) If the elevation of the spillway needs to be raised or lowered:
   Select the spillway group, then click Modify...Edit Elevations...Raise/Lower...
   Then input the elevation change E.g. { -3}. Press Enter.

Move and rotate the spillway as a group to make the layout fit the site. Use the User Defined Contours to help keep the level section and straight outlet section of the spillway bottom in cut.

25) Turn off the OsnapZ elevation setting: Type Osnapz Press Enter, Type 1 Press Enter (This allows you to use Osnaps without changing the Elevation of the objects.)

26) To move the spillway layout and maintain the same elevation:
   a) Select any line of the spillway, Right-Click Basic Modify... Move...
   b) Shift + Right-click Endpoint to Point A of the spillway dike.
   c) Shift + Right-click Nearest along the (B) upstream top of fill so that the level section is in cut.

27) To rotate the spillway layout:
   a) Select any line of the spillway.
   b) Right-Click Basic Modify... Rotate...
   c) Shift + Right-click Endpoint to the pivot point A.
   d) Move your cursor to obtain the new rotation angle and click to set it.
   Repeat as needed.

The Move and Rotate steps can also be used after the grading has been applied.

28) Save the drawing.

Grade the slopes for the preliminary auxiliary spillway layout.

29) Click Home... Create Design... Grading... Grading Creating Tools...
30) Click Set the Grading Group
31) Set the Site to Auxiliary Spillway.
32) Click Create Grading Group
33) Input a Grading Group Name E.g. { Auxiliary Spillway } Click OK Click OK
34) Click Set the Target Surface. Select Ognd. Click OK

Uphill & Downhill Spillway grading (preliminary)
35) Pulldown the Select a Grading Criteria to Slope or Grade to Surface (Cut)
36) Click Create Grading.
37) Select the outside edge of the auxiliary spillway. Click outside of the edge.
38) Apply to entire length? Input Y Press Enter
39) Slope or grade? Input S Press Enter.

41) Select the inside curve of the spillway outlet. Click inside of the curve.
42) Apply to entire length? Input Y Press Enter
43) Slope or grade? Input S Press Enter.

45) Select the inside curve of the spillway inlet. Click inside of the curve.
46) Apply to entire length? Input Y Press Enter
47) Slope or grade? Input S Press Enter.

49) Pulldown the Select a Grading Criteria to Slope or Grade to Surface (Cut and Fill)
50) Click Create Grading.
51) Select the downslope edge of the spillway dike. Click away from the spillway.
52) Apply to entire length? Input Y Press Enter
53) Slope or grade? Input S Press Enter.
55) Slope or grade? Input S Press Enter.
57) Press ESC
58) Close the Grading Tool
59) Save the drawing.

Evaluate the preliminary auxiliary spillway layout. The fill segments of the inlet and outlet will be trimmed off later.
- Is the outside cutslope on the spillway excessive?
- How do the inlet and outlet sections blend into the ground?
- Does the dike toe extend too far downhill?

Move or rotate the spillway group to improve the layout. The gradings will update automatically.

Create a feature line across the inlet and outlet at the zero cut locations of the spillway
60) Type Osnapz Press Enter, Type 0 Press Enter
61) Home… Create Design… Feature Line…Create Feature Line …
62) In the Create Feature Lines box,
   a) Set the Site = Auxiliary Spillway,
   b) Checkmark Style = Auxiliary Spillway Feature Line,
63) Click Ok.
64) Osnap to the Endpoint of the inlet left Zero cut
65) Press Enter
66) Osnap to the Endpoint of the inlet right Zero cut
67) Press Enter, Press Enter
68) Press Enter to restart the Feature Line command
   a) Set the Site = Auxiliary Spillway,
   b) Checkmark Style = Auxiliary Spillway Feature Line,
69) Click Ok.
70) Osnap to the Endpoint of the outlet left Zero cut
71) Press Enter
72) Osnap to the Endpoint of the outlet right Zero cut
73) Press Enter, Press Enter

Remove all 4 auxiliary spillway gradings & the 2 embankment gradings.
74) In the drawing select the gradings. Click Gradings...Modify... Delete...

Trim off the fill segment of the inlet / outlet curves
75) Modify... Edit Geometry... Trim...
76) Cutting edge? Select the feature lines added across the inlet and outlet zero cut
   locations. Press Enter
77) Object to trim? Click the upstream and downstream edges past the trim lines.
78) Press Enter

Trim Embankment and Spillway dike for merging.
79) NRCS ... NRCS Storage Ponds... Turn Off: Selection by Group.
80) Modify... Edit Geometry... Trim...
81) Cutting edge? Select the feature lines of dike & embankment (A x3). Press Enter
82) Object to trim? Click the interior lines. (B, C, D)
83) Press Enter.
84) Osnap the ends of the embankment feature lines to the top of dike Endpoints so elevations will match.

Join the dike top to the embankment feature lines
85) Modify... Edit Geometry... Join...
86) Select the downstream embankment feature line (E).
87) Select the dike edge feature line (F). Press Enter
88) Modify... Edit Geometry... Join...
89) Select the upstream embankment feature line (G).
90) Select the upstream dike feature line (H). Press Enter
Move all of the auxiliary spillway feature lines to the Grade stabilization site.

91) Toolspace> Prospector… Sites… Auxiliary Spillway… Right click Feature Lines…
    Click Move to Site…
92) Set Destination Site = Embankment
93) Click Ok
94) Save the drawing

Create Final Embankment and Spillway Gradings

95) Click Home… Create Design… Grading… Grading Creating Tools…
96) Click Set the Grading Group.
97) Set the Site to Embankment. Click OK
98) Set the Group Name as Embankment. Click OK
99) Click Set the Target Surface, Select Ognd. Click OK

Uphill & Downhill Spillway grading

100) Pull down the Select a Grading Criteria to Slope or Grade to Surface (Cut)
101) Click Create Grading.
102) Select the outside edge of the auxiliary spillway. Click outside of the edge.
103) Apply to entire length? Input Y Press Enter
104) Slope or grade? Input S Press Enter.

106) Select the inside curve of the spillway outlet. Click inside of the curve.
107) Apply to entire length? Input Y Press Enter
108) Slope or grade? Input S Press Enter.

110) Select the inside curve of the spillway inlet. Click inside of the curve.
111) Apply to entire length? Input Y Press Enter
112) Slope or grade? Input S Press Enter.
114) Press ESC

**Note:** For embankments with a blister berm go to the HowTo- Pond Embankment Blister Berm C3D document. Continue at Placing the Toes and Blister Berm of the Dam: “Downstream toe”.

**Note:** For embankment with a wave berm or no berm go to the HowTo- Pond Embankment C3D document. Continue at Placing the Toes and Wave Berm of the Dam: “Downstream toe”.